

CALIFORNIA STATE TEACHERS' RETIREMENT BOARD

INVESTMENT COMMITTEE

SUBJECT: Fixed Income –
U.S. Benchmark Recommendation

ITEM NUMBER: 6

ATTACHMENT(S): 2

ACTION: X

DATE OF MEETING: June 5, 2002

INFORMATION: _____

PRESENTER(S): Michelle Cunningham
Glenn Hosokawa
Paul Shantic

EXECUTIVE SUMMARY

Given the importance associated with the selection of the performance benchmark for any given asset class, CalSTRS typically reviews the continued suitability of its performance benchmarks every three to four years. The last such review for the fixed income asset class took place in March 1999. Therefore, one of the objectives approved for the Investment Branch for FY2001/2002 is to re-examine the universe of fixed income performance benchmarks and to study, evaluate, and recommend whether the current fixed income benchmark, the Salomon Brothers Large Pension Fund Index (LPF Index), remains suitable for the fixed income assets. The LPF Index has been used as the CalSTRS Fixed Income Performance Benchmark for the past fifteen years.

As a first step in this process, at the April 2002 Investment Committee meeting, staff presented its plan to research and review each of the major fixed income performance benchmark providers. **Attachment 1** represents the findings of that research, including a discussion regarding the evolution of the world bond markets over the past decade and the significance of those changes, with respect to the selection of a performance benchmark. Additionally, the key characteristics of each of the major fixed income benchmarks are presented, in order to compare similar attributes across the various indexes and providers. Each of the findings and conclusions were shared and discussed with Pension Consulting Alliance (PCA).

RECOMMENDATION

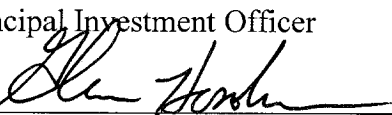
Based upon the analysis and conclusions presented within **Attachment 1**, staff and PCA recommend the following for the Investment Committee's consideration and approval:

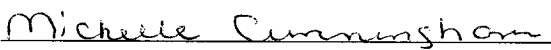
- 1) That the Board adopt the Lehman Brothers U.S. Aggregate Index (ex-Tobacco) as the performance benchmark for the evaluation of the System's internally managed long-term fixed income portfolios, effective July 1, 2002.
- 2) That the Board delegate the implementation of the restructuring of the internally managed long-term fixed income assets as a result of the selection of the new performance benchmark to staff, with status reports made to the Board at least on a quarterly basis.
- 3) That the Board approve the attached Board Resolution (**Attachment 2**)

Date prepared: 05/22/2002


By:


Paul Shantic
Principal Investment Officer


Glenn Hosokawa
Principal Investment Officer


Michelle Cunningham
Director of Fixed Income

Review & Concur:


Christopher J. Ailman
Chief Investment Officer

REVIEW OF U.S. FIXED INCOME (BOND) BENCHMARKS

BACKGROUND

In 1987, the California State Teachers' Retirement Board (Board) established a preference for a performance benchmark (index) for the domestic long-term core fixed income portfolios that took into consideration the long-term nature of the Fund's liabilities. In other words, liquidity was not determined to be an issue for these assets. As a result, the Investment Committee adopted the Salomon Brothers Large Pension Fund Index (LPF Index) as the performance benchmark for the System's long-term fixed income assets. The LPF Index was unique at the time in that it was a fixed-weighted customized index constructed to: 1) exclude any fixed income security that had less than seven years to maturity and, 2) include a fixed re-weighting of the sectors of the U.S. fixed income market to overweight investment-grade corporate and mortgage-backed securities relative to U.S. Treasuries (i.e., 40% U.S. Treasuries/Agencies, 30% Corporate Bonds, 30% Mortgage-Backed Securities). This departure from the typical market capitalization weights of the fixed income markets, combined with the minimum maturity of seven years, provided a less liquid, longer duration¹ benchmark with a higher yield.

Given the financial impact of the decision regarding the performance benchmark, staff and Pension Consulting Alliance (PCA) have reviewed and evaluated the selection of the LPF Index approximately every three to four years. The most recent review took place in March 1999, and the findings at that time were that the LPF Index continued to be an appropriate performance benchmark for CalSTRS' domestic long-term fixed income assets. The use of the LPF Index provided continuity for management purposes, and performed as expected: the duration has remained fairly constant and the returns/yields had been generally higher than other widely used domestic fixed income indexes due to the long secular decline in interest rates over the past decade. However, with the evolution of the fixed income markets, many of the minor bond segments of ten-to-fifteen years ago are now playing a much larger role and many of the more traditional bond issuers are becoming less frequent borrowers within the debt markets. This decline in traditional borrowers has been especially true for the U.S. Government, which has become a less frequent borrower due to the dramatic decline in the federal deficit. The issuance of U.S. Treasury securities has declined significantly and corporate borrowings have increased. As a result, it was recommended that, at the next benchmark review, consideration should be given with respect to how to integrate these changes into the fixed income portfolio in the future.

¹ Duration is a measure of price sensitivity (risk) to interest rates. Duration is the percentage move in price that is anticipated, given a 100 basis point (1 percent) move in interest rates.

THE ROLE OF FIXED INCOME (BONDS)²

Fixed income assets can be considered unique, in that they represent an investment class that bridges the risk and return characteristics between cash equivalents and stocks. Within the asset allocation process at CalSTRS, domestic fixed income investments provide diversification to the System, in that a bond portfolio has investment characteristics that differ from other asset classes, most specifically, a portfolio of publicly traded equity. Although bonds do fluctuate in value just as equities, bonds do not always move in the same direction, or to the same degree, as equities. As a result, bonds serve as a risk reducer and provider of stable returns for a diversified investment portfolio. At 26%, CalSTRS' current asset allocation policy weighting to domestic fixed income assets constitutes the second largest proportion of the System's total investment assets³.

In addition, bonds also provide liquidity and cash flow over varying lengths of time. In an institutional fund such as CalSTRS, significant amounts of income originating from the bond segment of the investment portfolio can be redirected to other asset classes (e.g. Equities, Alternative Investments or Real Estate) and designated to pay plan benefits without selling principal out of the other asset classes. In this respect, bonds play an important tactical role within a portfolio that, otherwise, has a long-term investment horizon.

THE U.S. FIXED INCOME (BOND) UNIVERSE

The world bond markets have more than doubled in size over the past decade, with an estimated market capitalization of almost \$33 trillion at December 31, 2001.⁴ The U.S. Bond Market comprises slightly more than half (51.9%) of this total, or approximately \$17 trillion. The following charts illustrate the evolution of the U.S. dollar fixed income universe since 1992.

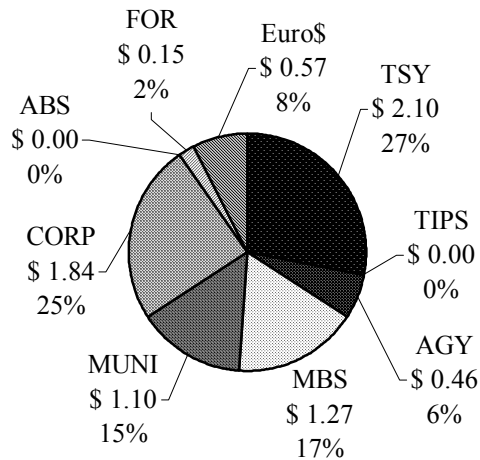
² This discussion of the Role of Fixed Income was contributed by Pension Consulting Alliance in a report dated March 3, 1999.

³ Domestic equities, with a policy weighting of 38% of total assets, is the largest asset class within the CalSTRS investment portfolio.

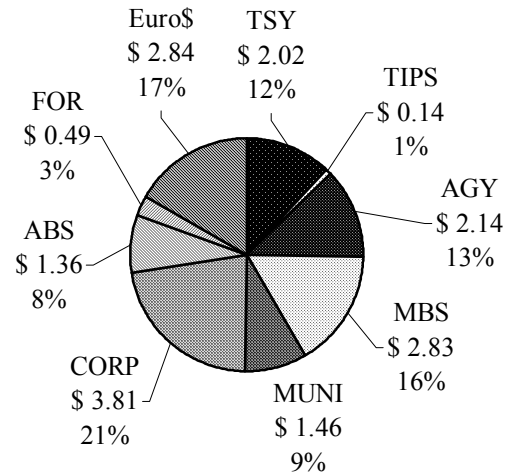
⁴ Merrill Lynch, "Size and Structure of the World Bond Market," April 2002.

U.S. DOLLAR BOND MARKET

1992 = \$ 7.49 trillion



2001 = \$ 17.09 trillion



TSY – US Treasury	MBS – Mortgage-Backed Securities	ABS – Asset-Backed Securities
TIPS – Treasury Inflation Protected Securities	MUNI – Municipal Bonds	FOR – Foreign Bonds
	CORP – Corporate Bonds	EURO\$ - Eurodollars
AGY – Agencies		

Source: Merrill Lynch

As the charts indicate, not only have the size of the bond markets grown significantly, but the composition of the bond markets have shifted dramatically, as well. The most notable shift has been in the declining share of U.S. Treasury debt and the subsequent increase in credit market growth, credit markets being defined as private/semi-private sector borrowing. Over the past decade, the U.S. Treasury segment of the bond market has basically remained stagnant at approximately \$2 trillion, while the private/semi-private bond markets have more than doubled in size. This shift in issuance/borrowing patterns has had an effect, not only on the relative value between the various bond sectors, but has also resulted in the development of new and more innovative structures involving corporations and special purpose entities that issue debt securities.

As the universe of available securities has expanded, the selection of a fixed-weighting benchmark has become unrepresentative of the opportunity set available to fixed income investors. For example, asset-backed securities (ABS) and innovative mortgage-backed securities (MBS) have become a larger segment of the market. As new investment vehicles are developed, investors are looking for ways to participate in and measure their performance within these new markets. Therefore, index providers are constantly developing new methods of measuring performance in the evolving fixed income universe.

FIXED INCOME BENCHMARK (INDEX) ALTERNATIVES

In consideration of the role that fixed income assets are intended to fulfill for the System, along with the evolution of the bond markets, the next step in this review is an evaluation of the alternatives available with respect to fixed income benchmarks. An analysis and comparison of

the major fixed income benchmarks is important because the risk-adjusted return implied by the index selected will impact not only asset allocation decisions going forward, but also evaluations regarding the performance of the fixed income assets within the investment portfolio.

Since CalSTRS does not have an allocation to non-dollar fixed income, this review will focus only on domestic investment-grade fixed income benchmarks for use by the internally managed fixed income portfolios. However, it is important to note that, given the globalization within the markets, each of the major providers does sponsor benchmarks that represent the full spectrum of non-dollar and high yield fixed income assets.

The variety of domestic investment-grade bond market indexes, for purposes of this review, can be classified as broad-based market indexes, specialized market indexes, and customized benchmarks. The broad-based market indexes are designed to be representative of the sectors within the bond market, whereas the specialized market indexes focus on a sector/sub-sector of the bond market, and customized benchmarks are designed to meet a fund's specific objective.

This evaluation will focus on the three major broad-based market indexes and the LPF Index that CalSTRS currently uses as its benchmark, which is considered a customized benchmark. The three major providers of fixed income benchmarks are Salomon Brothers, Lehman Brothers, and Merrill Lynch. Each of these providers will be compared in terms of the major characteristics of each benchmark, including an assessment of the providers' commitment of resources to supporting its family of benchmarks, and a risk-adjusted return analysis.

Important Characteristics of Major Fixed Income Benchmarks⁵

Several characteristics are important when comparing bond indexes. First, the universe of securities that is included within the index must be defined. Users want to know how many bonds are in the index, the maturity and issue size requirements, and what sectors are included. Second, whether the weighting of the sectors within the index are based upon their relative size in the bond market (market capitalization weighted) or whether they're fixed at a constant weighting is an important consideration. Third, the quality and availability of the pricing data for the issues within the index is of concern. In other words, is each issue hand-priced by a bond trader or by some sort of matrix, and when is it available to clients for pricing their portfolios? Finally, it is important to get a sense of the resources, both in terms of personnel and technology that the providers are committing, and will continue to commit, toward the support of their benchmark.

With these thoughts concerning the important characteristics of a fixed income benchmark, a simple matrix of the major indexes under consideration has been assembled. The following table compares each of these important characteristics among each of the major indexes.

⁵ Reilly, Frank K. and Wright, David J., "An Analysis of High Yield Bond Indices", High Yield Bonds, 1999, pp. 336-367.

PERFORMANCE BENCHMARK COMPARISON OF CHARACTERISTICS

	Salomon Bros. LPF Index	Salomon Bros. BIG Index	Lehman Bros. Aggregate Index	Merrill Lynch US Broad Index
# of Issues	2000+	4200+	6700+	5800+
Market Value (\$ tr.)	\$4.154	\$6.474	\$6.875	\$6.778
Maturity	Non-MBS \geq 7yrs	\geq 1yr	\geq 1yr	\geq 1yr
Avg. Duration**	7.15	4.61	4.54	4.77
Min. \$ Outstanding***	UST: \$1 bill AGY: \$200 mill Credit: \$200 mill MBS: \$500 mill ABS: \$200 mill	UST: \$1 bill AGY: \$200 mill Credit: \$200 mill MBS: \$500 mill ABS: \$200 mill	UST: no min. AGY: \$150 mill Credit: \$150 mill MBS: \$500 mill ABS: \$500 mill CMBS: \$300 mill	UST: \$1 bill AGY: \$150 mill Credit: \$150 mill MBS: \$150 mill ABS: \$25 mill
Sector Weighting	Fixed*	Mkt. Cap.	Mkt. Cap.	Mkt. Cap.
Quality	Investment Grade	Investment Grade	Investment Grade	Investment Grade
Pricing Quality	Trader/Matrix	Trader/Matrix	Trader/Matrix	Trader/Matrix
Portfolio Pricing	Next day, 9am EST	Next day, 9am EST	Daily, 4:30pm EST	Daily, 6:00pm EST
Index Committee	No	No	Yes	No
CalSTRS Participation	N/A	N/A	Yes	N/A
Global Capabilities	Yes	Yes	Yes	Yes
High Yield Indexes	Yes	Yes	Yes	Yes

* Fixed weighting of 40% UST/AGY, 30% Credit, 30% MBS (vs. a market capitalized weighting).

** A bond with a duration of 5 will go up or down in value 5%, or approximately \$50,000 per million, for every corresponding 1% move in interest rates ($1,000,000 \times .01 \times 5$).

***Lehman will be reevaluating its liquidity restraints for issues within the index in July 2002.

As the table above illustrates, there appear to be few differences between many of the characteristics of the major fixed income benchmarks included within this review. The main differences are structural between the Salomon LPF Index (i.e. CalSTRS' current customized benchmark) and the group of broad-market indexes. The LPF Index is restricted to assets with maturities exceeding seven years and has a fixed weighting between the sectors, which results in an index containing fewer issues and a longer duration. The impact of this restriction is a smaller opportunity set versus the overall fixed income market. For example, there are approximately 4700 more issues, with a market value of \$2.7 trillion, available within the Lehman Brothers U.S. Aggregate Index as compared to the LPF Index. The ability to invest fixed income assets across the yield curve from one to seven years in maturity would be an attractive opportunity set not currently available. Furthermore, given the decline in U.S. Treasury issuance by the U.S. Government, the fixed weighting of 40% to U.S. Treasury and Agency securities over-weights the sector, as opposed to the preference toward under-weighting the sector when the LPF Index was originally developed. The characteristics among each of the three broad-market indexes are virtually identical, with the exception of the Lehman Aggregate, which includes the Commercial Mortgage-Backed Securities (CMBS) market.

Historical Performance Characteristics of Major Fixed Income Benchmarks

In order to compare the risk-adjusted returns among each of the performance benchmarks within this review, staff followed-up on a study conducted by Reilly, Kao, and Wright, whereby they performed extensive statistical analysis on the broad-market indexes from 1976 to 1990.⁶ Their research did not include the Salomon Brother LPF Index, because customized indexes were not considered as part of the study. What Reilly, Kao, and Wright found was that, although there could be some variation in risk and return among the benchmarks month to month, over the long term, the correlation of annual risk and return among the three broad-market indexes was around 98%. Therefore, based upon a risk-adjusted return analysis, any of the three broad-market indexes would perform similarly over a long time period.

Based upon the Reilly, Kao and Wright study, staff performed a similar exercise that included the major fixed income broad-market indexes as well as the customized LPF Index. One commonly accepted method of comparing returns on a risk-adjusted basis is the Sharpe Ratio, developed by William Sharpe.

What follows is the Sharpe Ratio (risk-adjusted return using monthly data) calculated by staff for the 1, 3, 5, and 10-year time periods ending December 31, 2001, for each of the benchmarks under consideration.

FOR THE PERIOD ENDING DECEMBER 31, 2001

	Salomon Bros. LPF Index	Salomon Bros. BIG Index	Lehman Bros. Aggregate Index	Merrill Lynch US Broad Index
Sharpe Ratio – 1 Yr.	0.191	0.299	0.295	0.286
Sharpe Ratio – 3 Yrs.	0.038	0.097	0.097	0.092
Sharpe Ratio – 5 Yrs.	0.153	0.191	0.189	0.189
Sharpe Ratio – 10 Yrs.	0.164	0.182	0.178	0.183

The Sharpe Ratio relates the average monthly excess return (index return less the risk-free rate) over the period to the standard deviation of monthly returns over the same time period. For example, the LPF Index achieved approximately 19 basis points of excess monthly return per unit of risk taken over the past year; approximately 10 basis points per month less than the broad-market indexes. In other words, the broad-market indexes, in all time periods, provided more return for less risk than the customized fixed-weighted LPF Index. This can be attributed in part to the broad-market indexes being more diversified than the LPF Index. Additionally, staff's analysis is consistent with the Reilly, Kao, and Wright study, in that there has been little variation in the risk-adjusted returns using monthly data among the broad-market benchmarks over the past decade.

⁶ Frank K. Reilly, G. Wenchi Kao, and David J. Wright, "Alternative Bond Market Indexes," Financial Analysts Journal, May-June 1992, pp. 44-58.

CONCLUSIONS

The objective of this review of fixed income benchmarks has been to determine if the current performance benchmark for the System's internally managed long-term fixed income assets, the Salomon Brothers' LPF Index, is still appropriate and consistent with accomplishing the investment performance objectives within CalSTRS' Investment Policy and Management Plan, the main goal of which is to achieve the actuarial assumptions and to strive to maintain a fully funded pension plan.

Based upon the preceding analysis, staff and PCA conclude that, although the LPF Index has served the System well over the past fifteen years, given the significant shift in the composition of the bond markets over the past decade and the subsequent change in borrowing patterns, the structure and composition of the LPF Index no longer suits the System's needs in terms of a performance benchmark for the long-term fixed income assets. The implications of this conclusion are significant in that it is predicated upon the view that the key role of the long-term fixed income assets at CalSTRS is to provide diversification in terms of the entire investment portfolio by means of a market-weighted portfolio of bonds that provide participation in the return of the fixed income asset class.⁷ This viewpoint differs from that of 1987, in which more weight in the determination of the fixed income performance benchmark was given to the long-term nature of the Fund's liabilities. As a result, staff and PCA propose a broad market-weighted performance benchmark for the System's internally managed long-term fixed income assets.

The research spanning nearly twenty-five years has shown that the structural characteristics and risk-adjusted returns are so similar between the major broad-market indexes, that they are 98% correlated. As a result, any of the three broad-market indexes would be suitable as a performance benchmark representing the fixed income markets. Therefore, the decision regarding which benchmark to recommend comes down to more qualitative factors, such as commitment of resources to the support of the benchmark and the perception of the acceptance by the fixed income investor base, as a standard for measuring the broad U.S. fixed income market performance.

Staff and PCA recommend the Lehman Brothers U.S. Aggregate Index (ex Tobacco) as the performance benchmark for the evaluation of the System's internally managed long-term fixed income portfolios for the following reasons:

- 1) Lehman Brothers estimates that 90% of the fixed income index users rely on Lehman's family of global indexes as performance benchmarks.
- 2) Lehman Brothers has an "Index Committee" whereby users of their index products can provide feedback on concerns or suggested changes to the indexes based upon changes in the fixed income markets. CalSTRS would be able to participate in that Committee.
- 3) Lehman Brothers appears to have a significant commitment of resources to the index business, which they consider a global franchise.

⁷ Barclays Global Investors, "Broad-Capitalization Indices of the U.S. Equity Market", date unknown, pp. 2-12.

- 4) The Lehman Brothers U.S. Aggregate dates back to 1973, at which time it was referred to as the Government/Corporate Index (reflecting the market structure at that time) thereby reflecting longevity in the index business.
- 5) Lehman Brothers has committed financial and staff resources to providing and enhancing analytics, risk modeling, and attribution analysis for its index users available in various platforms.

SOURCES:

“Alternative Bond Market Indexes,” Financial Analysts Journal, May-June 1992, pp. 44-58.

“An Analysis of High Yield Bond Indices”, High Yield Bonds, 1999, pp. 336-367.

“Benchmark Portfolios and the Manager/Plan Sponsor Relationship”, Jeffery Bailey, CFA, Thomas Rihcards, CFA, and David Tierney, PhD, “The Journal of Portfolio Management”, reprinted from Current Topics in Investment Management, 1990.

“Bond Index Rules & Definitions”, Merrill Lynch Fixed Income Analytics, October 12, 2000.

Bond Markets Analysis and Strategies, Frank J. Fabozzi, 1996.

“Broad-Capitalization Indices of the U.S. Equity Market”, Barclays Global Investors, date unknown, pp. 2-12.

“Evaluating Performance Against the Changing U.S. Bond Market”, Teri Geske, Capital Management Sciences Market Flash/BondEdge for Windows, February 28, 2001.

“A Guide to the Lehman Global Family of Fixed Income Indices”, Steve Berkley and Nick Gendron, Lehman Brothers Fixed Income Research, February 2002.

The Handbook of Fixed Income Securities, Frank J. Fabozzi, 1991.

High-Yield Bonds Market Structure, Portfolio Management, and Credit Risk Modeling, Theodore Barnhill, Jr., William Maxwell and Mark Shenkman, 1998.

“The Importance of Index Selection”, Christopher Luck, CFA, AIMR, 2001.

“Index Shifts Increase Volatility in Fixed-Income Markets”, Dave Kovaleski, Pension & Investments, September 17, 2001.

Pension Consulting Alliance, Report, March 3, 1999.

“Size and Structure of the World Bond Market,” Merrill Lynch, April 2002.

RESOLUTION OF THE
TEACHERS' RETIREMENT BOARD
INVESTMENT COMMITTEE

SUBJECT: U.S. Fixed Income Benchmark Change

Resolution No. _____

WHEREAS, the Investment Committee of the California State Teachers' Retirement Board is responsible for recommendations to the Board on investment policy and overall investment strategy for the management of the Teachers' Retirement Fund, a multi-billion dollar public pension plan; and

WHEREAS, the Investment Committee is charged with designating the Fund's benchmark for each asset class; and

WHEREAS, the Investment Committee has received and reviewed written recommendation for the benchmark change and has heard oral presentations from Staff; and

WHEREAS, Pension Consulting Alliance (PCA) and Staff have recommended the adoption of the Lehman Brothers U.S. Aggregate Index (ex-Tobacco) as the Fund's U.S. Fixed Income Benchmark for the Fund's Internally Managed Long-Term Fixed Income portfolios, effective July 1, 2002; Therefore, be it

RESOLVED, that the Investment Committee of California State Teachers' Retirement Board adopts the Lehman Brothers U.S. Aggregate Index (ex-Tobacco) as the benchmark for the internally managed long-term fixed income assets.

Adopted by:
Investment Committee
on June 5, 2002

Jack Ehnes
Chief Executive Officer